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A STUDY OF INSECT INFESTATIONS ON THE YAKIMA FOREST

by
DAN MEYER

Forester - Yakima Agency

April 18, 1959

OFFICE PRIN.

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FOREWARD

Over the years a large amount of data concerning insect attacks, and related control activities, have accumulated in the Agency files. For the most part, the data are presented in the form of annual reports, special reports, memorandums, letters and maps. As such, it is difficult to trace the development of an attack, or control programs without consulting a score of references.

The present report is designed to provide a condensed account of the major insect infestations of the forest in the sequence in which they happened. Whenever possible, the data have been summarized in tabular or graphical form to facilitate comparisons and point up trends.

We seldom can afford, with present day costs, to conduct a continued investigation over a 25 year period with the same personnel. However, this has been the case on the Yakima Reservation. Moreover, the men involved were highly qualified and recognized experts in their fields. It is felt that a concise report of their findings will be of value in managing the Reservation's forest lands.

I. 1893-1895

The first insect epidemic of which there is a definite record was that of the pine butterfly (*Neophasia menapia*) from 1893 through 1895. According to early reports, vast numbers of these butterflies descended on the pine stands of Cedar Valley. (Fig. 1) So numerous were these insects, they made the pine appear white. Streams were choked with dead butterflies, and travelers through the region, at that time, declared that horses and men would be covered from head to foot with the webs of caterpillars. (1)

Cedar Valley, prior to the attack, reportedly supported a magnificent, park-like ponderosa pine forest. Although estimates of volume loss varied from $\frac{1}{2}$ to $2\frac{1}{2}$ billion feet, the accepted figure is somewhat less than 1 billion feet. It is safe to say that one-half of the original stand was destroyed as a result of the butterfly attack. (9,20)

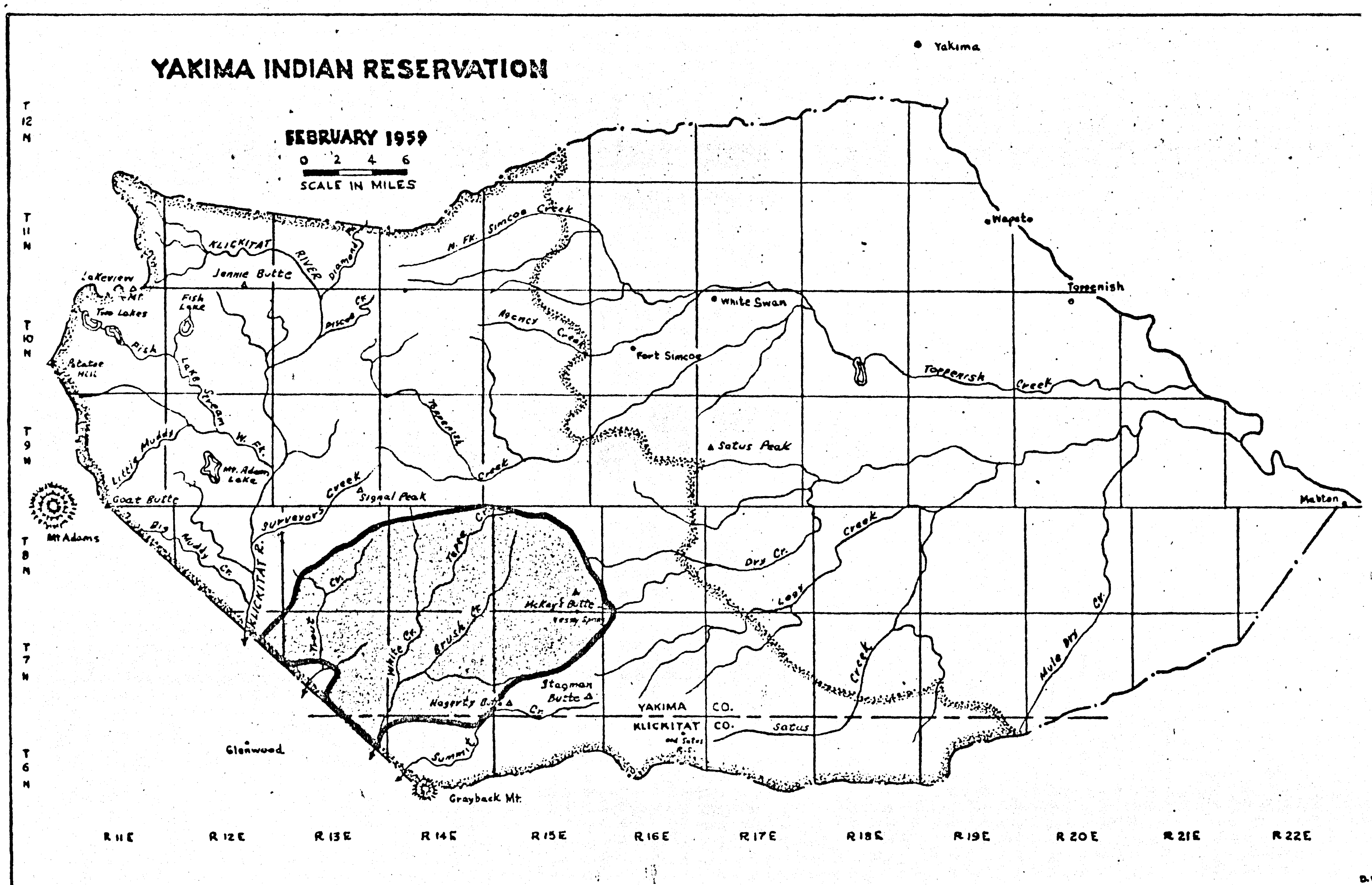
The epidemic apparently ended as suddenly as it began. According to an early account, the insects were scarcely noticeable during the summer of 1896. According to one theory, the rapid decline of the butterfly might have been caused by the smoke which drifted into the valley from large forest fires in the south and west. The fact that the infested area did not extend beyond the smoke filled area of 1895, lent support to this theory. However, the actual cause of the decline was probably the work of *Theronia fulvescens*, a wasp-like parasite of the butterfly. During the third year of a similar epidemic in central Idaho in 1922, over 90% of the caterpillars were parasitized by this insect. (20)

The Reservation has never been entirely free of the butterfly since the epidemic. Each season some are seen flitting through the crowns in the pine stands. However, with the advent of modern insecticides and aerial spraying, the pine butterfly no longer represents the threat to the forest it once did.

II. 1912-1930

A. In December 1912, Mr. Harvey, of the Bureau of Entomology, visited the Reservation in connection with his study of the effects of wood-boring insects on fire or insect killed trees. The information furnished by him indicates that in addition to the extensive defoliation by the pine butterfly, there was an extensive invasion of the

FIG.1 MAP OF PINE BUTTERFLY EPIDEMIC OF 1893-95



western pine beetle which he felt was the real cause of death of most of the trees. Mr. Harvey also reported that the pine timber killed in 1893-1895 was no longer of commercial value, due to insect borings and decay. It is interesting to note the Bureau's recommendation that the overmature timber should be cut and utilized in order to control the pine beetle. (2)

B. Little is known of the insect activities on the reservation from 1912-1925. However, three reports concerning beetle infestation were made in 1928. The first, by W. H. Zeh, noted that there were several areas infested with beetle, but that the infestation was definitely declining. (Fig. 8) In September of that year, J. C. Evenden also reported that the infestation was less than in the previous year. Furthermore, he felt that the infestation on the Reservation was endemic, and required no control measures at that time. (3,4)

A third survey, by J. P. Drissen, revealed essentially the same trend, but supplied actual counts of tree mortality. Beetle killed trees along 14½ miles of road from Vessey Springs to the Satus Station were tallied as time of kill, based upon foliage discoloration. (i.e. red-current season, sorrel-previous years.) A total of 101 trees were tallied on a 5 chain strip, or an average kill of 111 trees per section from 1926 to 1928. Again, the scarcity of 1928 killed trees was stressed.

In 1929, Drissen inspected the pine stands, including those of Cedar Valley, and reported a further decrease in beetle activity throughout the forest. In spite of a long and dry summer, the pine stands appeared thriftier than the previous year. Drissen attributed this to the extra heavy snow fall of the previous winter. (5)

Based on the above reports, there appeared to be an endemic level of beetle during 1926-1929. Furthermore, the infestation seemed to be continually decreasing until in 1929 it appeared to be at a very low level.

In order to prevent a buildup of western pine beetle, careful attention was given to the disposal of slash during the construction of the Pacific Power and Light transmission line across the forest in 1930. Branches were lopped from pine logs and later burned. The logs

were left in the open, exposed to the sunlight as much as possible. Some loss from engraver beetles was expected, but was considered minor, and unavoidable under the circumstances. The careful handling of the felled material was largely nullified one year later.

III. 1931-1935

A. In April 1931, a catastrophic wind storm laid down an estimated 50 million feet of timber on the Reservation. The downed material served as favorable breeding grounds for various bark beetles. The situation was further aggravated by the drought conditions and the resultant poor growth. The here-to-fore endemic beetle attack rapidly became an epidemic infestation.

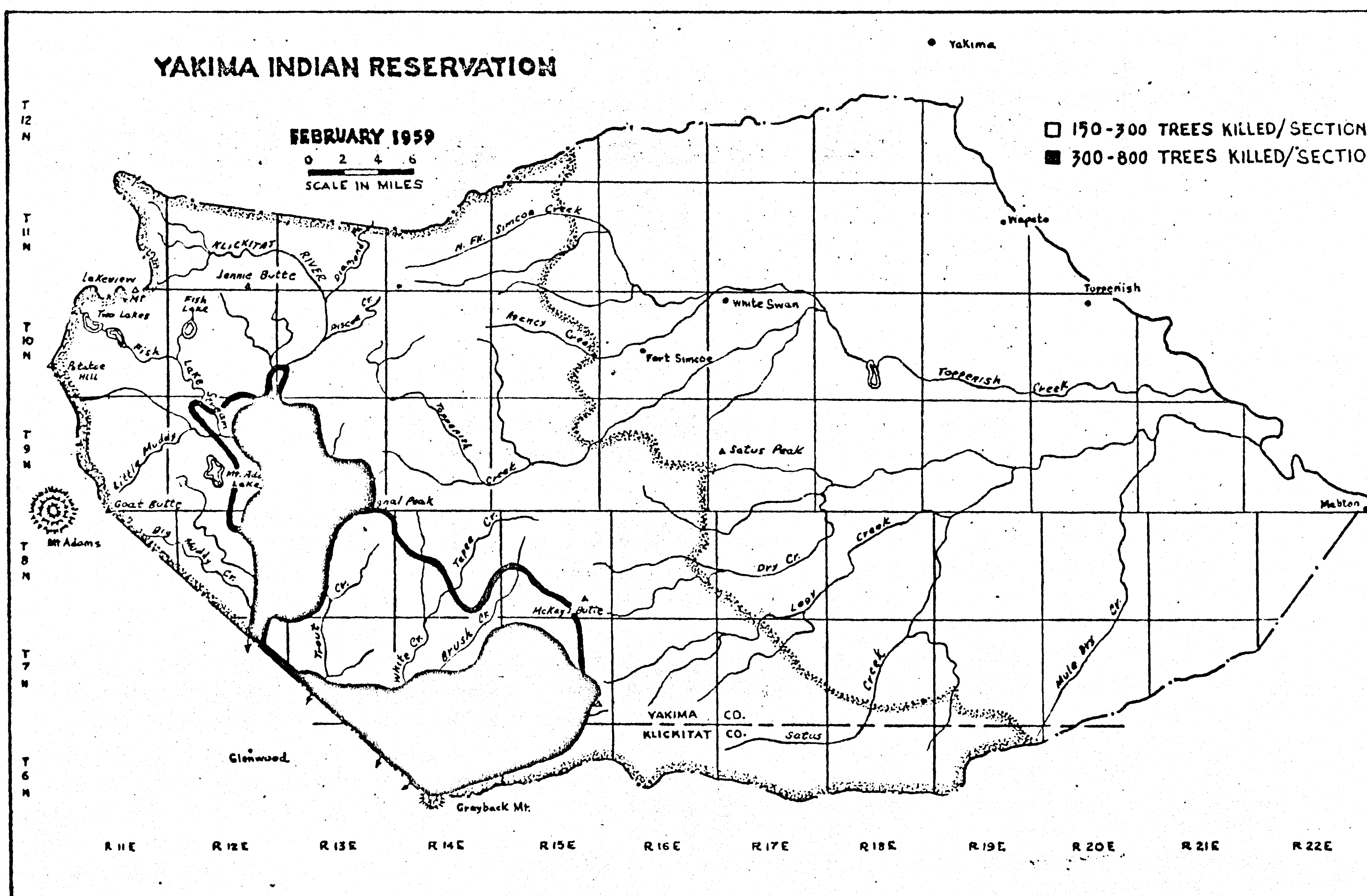
B. In 1932, at the request of the Vernon Parish Lumber Company, F. P. Keen examined the Company's lands in the lower portion of Cedar Valley (now J. Neils' holdings). Keen reported a very severe beetle epidemic had claimed approximately 350 trees per section in 1931, and that the number had increased to nearly 600 in 1932. (6)

C. The following year, Mr. Keen made an extensive survey of the Reservation's forest lands. The two general areas which contained the heaviest infestation of beetles were portions of Cedar Valley and the upper Klickitat basins. (See Map Fig. 2) The Toppenish Creek Drainage, and those of Dry, Logy, and Satus Creeks showed only moderate losses. (7)

An additional beetle survey was conducted in 1933 by J. D. L. Drake. (8) Although, his report cannot be located in the Agency files, several references to it indicate that it was in substantial agreement with Keen's, with one notable addition. Drake reported that the heavy losses in lower Cedar Valley were declining, but that increasingly heavy losses might be expected in the Surveyor Creek and Klickitat drainages. In November 1933, in accordance with the recommendations of Keen and Drake, there began an intensive beetle control program. Personnel and funds for the project were made available under the I.E.C.W. and CCC-ID programs.

D. Essentially, the beetle control project consisted of "spotting" beetle infested or "brood" trees, felling these trees and peeling and burning the bark. Foliage

FIG.2 MAP OF PINE BEETLE EPIDEMIC OF 1933



discoloration, woodpecker work, pitch tubes and sawdust in bark crevices were helpful in "spotting" beetle trees. Trees which showed signs of beetle attack, but not the beetle itself were neither marked nor treated. A 100% coverage was obtained, by running strips of uniform width back and forth across the area. Infested trees were marked and their location mapped for the treating crews. (9)

E. Control operations began on the broad ridges and slopes at the head of Surveyor's Creek in the fall of 1933. By spring of 1934, nearly 3,000 trees had been treated. On one section alone in this area (32, T9N., R13E.), over 700 brood trees, with a volume in excess of 700,000 bd. feet, were treated.

When this type of control was permanently discountinued, seven years later, approximately 10,000 trees and nearly 95,000 acres had been treated. (14) The majority of the work was confined to the Klickitat drainages, particularly in Townships 8 and 9 N., Range 12 and 13 E.. Some control work was also done in Cedar Valley and in the Satus Pass area. Though Southern Cedar Valley had extremely heavy beetle concentrations, it was not given priority for two reasons: First, the stand of merchantable pine was very light due to past natural catastrophes; and second, a high percentage of the land was alienated.

Apparantly, these control operations had a measurable effect on the beetle infestation. The effectiveness of the "fell-peel-burn" method is dicussed later in this report.

F. In 1934, in order to obtain reliable data on beetle losses, locate epidemic concentration's, and determine infestation trends, a continuous beetle survey was instituted in conjunction with control activities. Survey data were collected in the three following ways: 1) from a number of widely scattered check plots, 320 and 640 acres in size, 2) from strip lines 10 chains in width, connecting the check plots, and 3) from roadside counts. Trees on check plots which were killed by beetle during 1931-1933, were tallied as to year of kill, and their volumes computed. Distinction between years was possible by observing the appearance of needles, bark, and wood, and the kind of insects present. In addition to the 100% cruise of beetle killed trees, a 10% cruise of green pine timber was made on each plot. This cruise was needed to determine what percentage of the stand was killed as a result of beetle attack.

An analysis of the check plot data, by H. Weaver, showed a steady increase in beetle killed trees from 1931-1933, and that approximately 300 trees per section were killed by beetles in 1933. The strip count data indicated that the mortality figure was nearer 220 trees per section. At any rate, losses were staggering and the infestation had unquestionably reached its peak. Natually, losses varied greatly among check plots, depending on beetle intensity, location, and stand composition and condition. However, it is significant to note that the highest losses occurred in Southern Cedar Valley, where 22% of the stand was lost in 1931-1933. (9)

In 1934 beetle losses were less than one-half those of the previous year, as the infestation began a rapid decline. (Table 1 and Fig. 3) By the end of 1935, the infestation had returned to an endemic level. Control measures declined, along with the beetle attack, and only 1165 trees were treated by the "fell-peel-burn" method after the 1935 season. Beetle losses during the 1931-1934 epidemic have been estimated at 185,000,000 feet. (16)

TABLE I

Board Foot Per Acre Losses on the Yakima and Eastern Washington Pine Forests During the 1933-34 Western Pine Beetle Epidemic.

YEAR	YAKIMA RESERVATION	EASTERN WASHINGTON
1931	140	160
1932	210	185
1933	290	240
1934	120	90

G. In 1935, F. P. Keen's newly developed bark beetle susceptibility classification was incorporated in the beetle survey. Both green and beetle killed trees on the check plots were classified according to Keen's system, which has since become the standard risk and vigor classification for ponderosa pine.

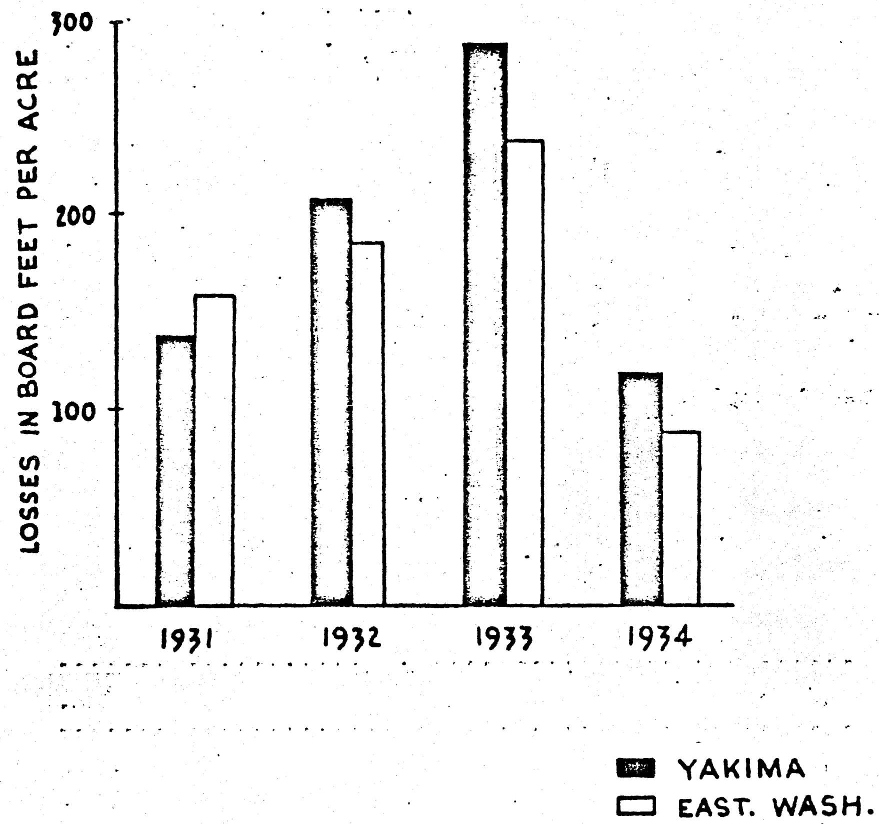


FIG. 3 BOARD FOOT PER ACRE BEETLE LOSSES ON THE YAKIMA, AND EASTERN WASHINGTON FOREST LANDS FROM 1931 TO 1934

An analyses of the data showed that approximately 34% or one-third of the forest was composed of trees considered to be highly susceptible to beetle attack. This fact clearly demonstrated the size of the task that lay ahead. It was apparent that even under the most favorable economic conditions, it would take years to cover the forest with a cut heavy enough to remove beetle susceptible trees. The only alternative was to attempt to control beetle epidemics by destroying brood trees. (12)

The 1935 check plot data were further analyzed in order to determine what classes of trees, if any, were actually preferred by the beetle in the 1935 attack. The number of green trees in each Keen class was expressed as a per cent of the total stand. Similarly, the number of beetle killed trees in each class was expressed as a percentage of the total killed. These data are presented in Table 2, and Fig. 4. Note that the beetle killed trees represented a good crossection of the stand. However, a closer inspection indicates a consistently different distribution of crown classes in the two groups of trees. The distributions of crown classes, among the green trees, are skewed to the left and indicate that the B crown class was most abundant in each age class. The crown class distributions among the beetle killed trees, on the other hand, are skewed to the right, and indicate that C crown class trees were attacked more frequently, even though they were not the most numerous. This would indicate a distinct preference for these individuals. Also significant, is the close agreement between the two distributions within the oldest age class. The agreement indicates that a very good sample of the total population of this age group was obtained in the beetle kill, and suggests that the insects attacked this group largely on the basis of what was available to them. The fact that this was the only class so selected, indicates a beetle preference for this age group. These conclusions are in substantial agreement with numerous other studies which indicate the beetle is not indiscriminate in its attack, but prefers the slower growing individuals in the stand. (20)

TABLE 2

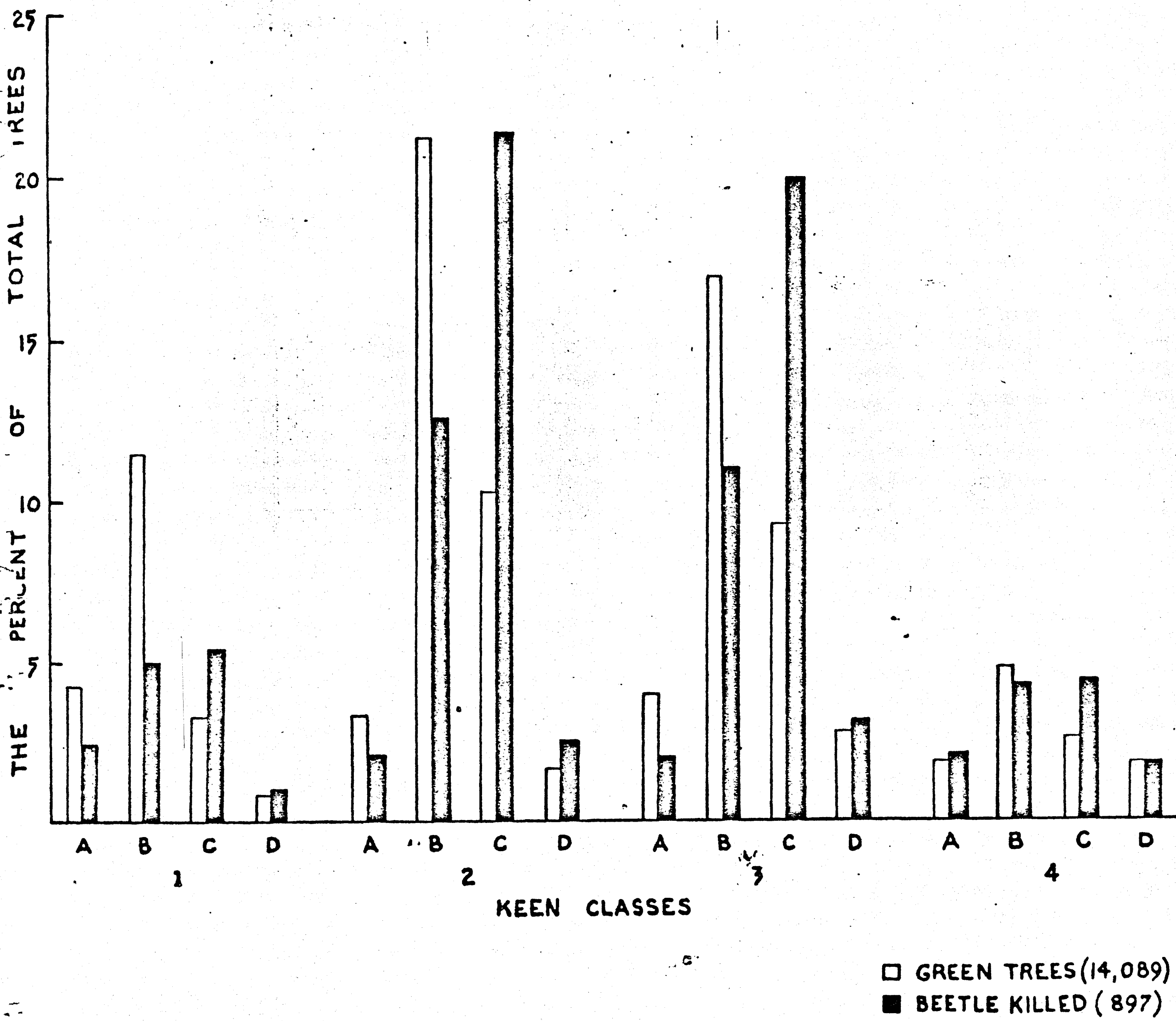
Distribution Of Keen Classes In Green And Beetle Killed Pine Trees, Based On 1935 Check Plot Survey.

(Figures Represent Per cent Of Total Trees)

KEEN CLASSES

	1				2				3				4				Total No. Of Trees
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	
Green Trees	4.1	11.4	3.2	.8	3.3	21.1	10.2	1.7	4.0	16.9	9.3	2.9	1.8	4.9	2.6	1.8	14,089
Beetle Killed Trees	2.5	4.9	5.3	.9	2.0	12.5	21.2	2.5	2.0	11.5	19.7	3.1	1.9	4.3	3.9	1.8	897

FIG.4 DISTRIBUTION OF KEEN CLASSES AMONG GREEN, AND BEETLE KILLED TREES (1935)



The surprising element in this data is the relatively high percentage of the younger age classes that were killed. Though this is normally expected in epidemic infestations, it is considered unusual under the endemic condition which existed in 1935. It is interesting to note that Mr. Weaver reported a surprisingly heavy killing of the younger age classes in his visit to the West Fork-Big Muddy Unit, nearly 25 years later, in what was termed a "light epidemic" year of beetle infestation.

IV. 1936-1949

A. Several of the original beetle check plots have been re-cruised each year. More recently, this work has been done by entomologists from the Pacific Northwest Forest and Range Experiment Station (hereafter referred to as the Experiment Station). The records from these plots provide the best available data for analyzing beetle losses and general infestation trends. (9-14,18,27)

Generally speaking, beetle losses vary directly with the susceptibility of the stand, and its proximity to heavy beetle concentrations. The small number of widely scattered check plots represent a wide range of stand conditions and necessarily exhibit extreme variations in beetle losses for any one year. As such, the plots do not provide a good basis for estimating annual losses and infestation trends on the entire forest. However, the plots are of great value in that they provide accurate data of beetle losses for a specific area and stand condition. Accordingly, the data presented herein are by individual plots, rather than averaged for "over-all" estimates of annual losses.

The severity of beetle attacks is usually best expressed in terms of number of trees killed, but it is often necessary to know what volume has been lost, in estimating damage or in preparing future management programs. Therefore both the number of trees killed per section and the volume per acre they represented have been summarized for each plot (Table 3). Records on four plots are complete to 1955, while records on the two others are complete only to 1950. (27)

TABLE 3

Number Of Trees Killed Per Pine Timbered Section
And Bd. Ft. Per Acre Losses Based On 6 Check Plots.

	Number Trees Killed/Section						Board Feet/Acre Loss					
YEARS	#4 Trout Creek W/2 17, 7-13	#6 So. Cedar Valley W/2 9, 6-14	#12 Castile Crossing W/2 13, 9-12	#14 Logy Creek W/2 10, 7-16	#15 Smith Spring E/2, 8-15	#16 Olney Corral W/2 27, 10-14	#4 Trout Creek	#6 So. Cedar Valley	#12 Castile Crossing	#14 Logy Creek	#15 Smith Spring	#16 Olney Corral
1931	36	527	153	40	23	30	34	405	222	38	18	23
32	81	425	186	40	23	30	102	338	264	38	18	23
33	104	560	363	42	16	54	116	427	466	38	9	28
34	75	355	220	159	91	37	45	180	275	64	47	27
1935	13	28	51	82	50	9	12	28	52	83	50	9
36	11	20	21	64	38	20	11	20	22	64	38	20
37*	9	13	62	91	76	14	9	14	54	91	76	14
38*	25	31	57	138	66	18	28	23	62	94	71	19
39*	23	37	55	141	98	17	28	30	59	103	93	14
1940*	23	59	47	161	125	30	29	52	59	139	136	28
41	38	48	66	174	156	21	36	60	100	195	157	15
42	50	48	54	174	126	19	57	35	96	199	215	10
43	44	14	38	64	50	6	50	8	66	57	66	11
44	24	16	56	106	57	19	25	32	100	123	88	22
1945	42	32	72	96	16	9	29	41	116	103	11	2
46	32	16	74	132	16	6	21	25	121	191	12	3
47	40	16	58	124	50	28	45	11	75	112	22	15
48	40	6	42	114	41	17	26	8	95	94	13	41
49	46	10	54	100	32	58	48	13	69	125	31	24
1950	32	2	128	172	32	55	31	5	230	233	27	46
51	28		158	188		55	40		326	235		49
52	60		492	294		64	42		708	316		64
53	38		52	122		49	19		81	135		72
54	24		144	122		62	18		250	132		90
1955	36		46	84		30	27		61	102		32

*Volume Estimated

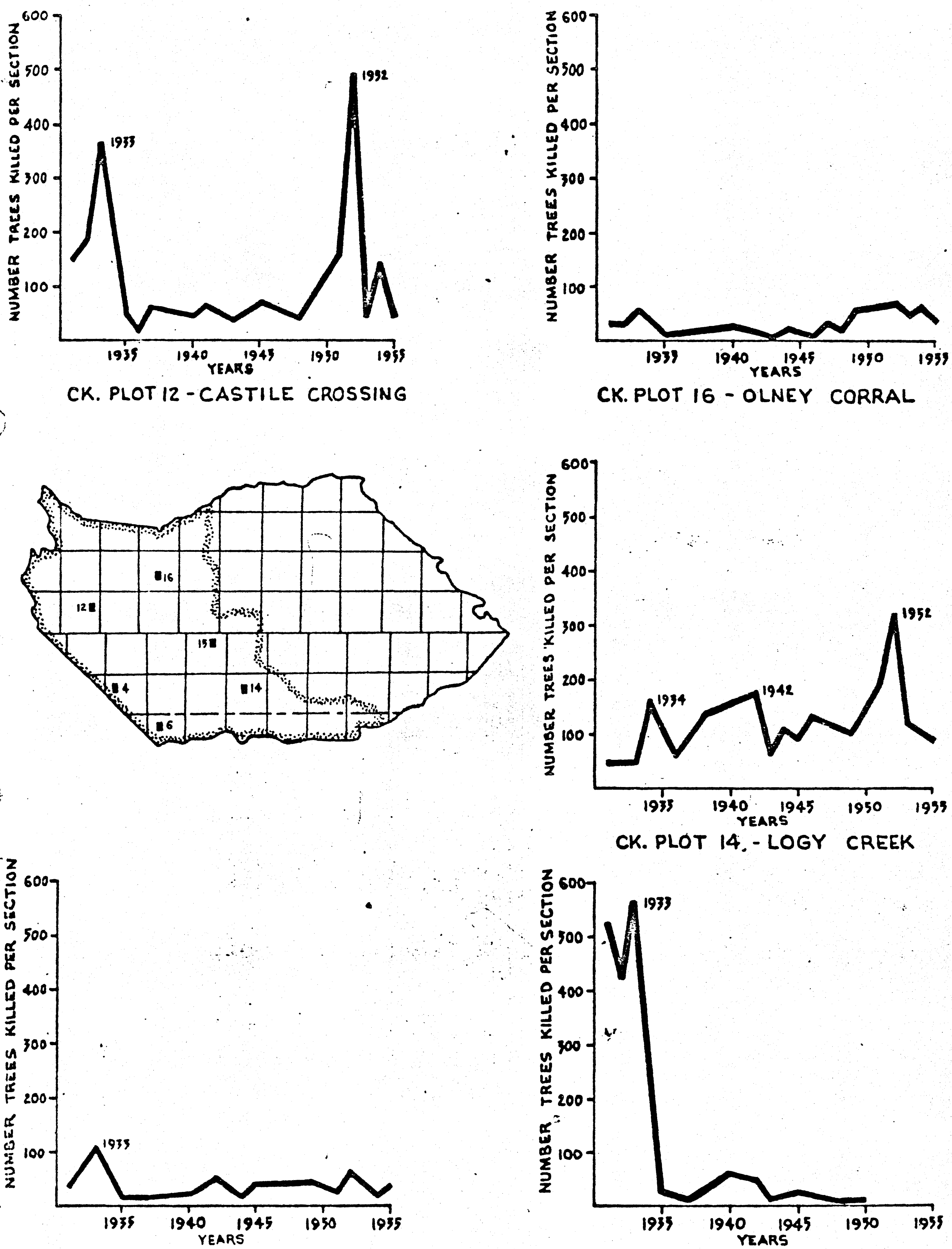
An examination of the plot losses reveals an extreme variation in beetle attacks in different forest areas. The Olney Corral plot, for instance, has yet to undergo a serious infestation. The Trout Creek and Cedar Valley plots show a rather low level of infestation since the 1931-1934 epidemic. The Logy Creek and Smith ~~Springs~~ plots, which escaped severe losses in the early 1930's, sustained a beetle epidemic in 1941-1942. The Logy Creek plot indicates that still another epidemic was in progress in the early 1950's. Its closest neighbor, Smith ~~Springs~~, showed small losses after the 1941-1942 attack, probably due to the sanitation-salvage cutting in this area in 1944. The Castile Crossing plot represents the only area which underwent a severe beetle epidemic subsequent to a severe 1931-1934 attack. Beetles again reached epidemic numbers in this area in the early 1950's.

Volume losses closely paralleled tree losses. An examination of the data (Table 3) indicated the volume of the average beetle killed tree was 600-700 bd. ft., regardless of infestation intensity. This figure, incidently, is about the volume of the average merchantable ponderosa pine on the Reservation, suggesting that a good crossection of the stand is killed both in endemic and epidemic beetle attacks.

The check plot records indicate that major epidemics, though concentrated in different parts of the forest, occurred in the first few years of each decade. (Fig. 5) Furthermore, these infestations remained high only 2 or 3 years and then dropped sharply. These sudden reductions, were no doubt due to climatic, and biotic factors.

Though the predatory clerid beetles generally increase with bark beetle populations, the combined efforts of these, and insectivorous birds, usually provide only a small measure of control. Furthermore there is no evidence of a bark beetle disease, similar to the "wilt" disease of certain caterpillars which flourishes in dense populations and ultimately plays a large part in controlling outbreaks.

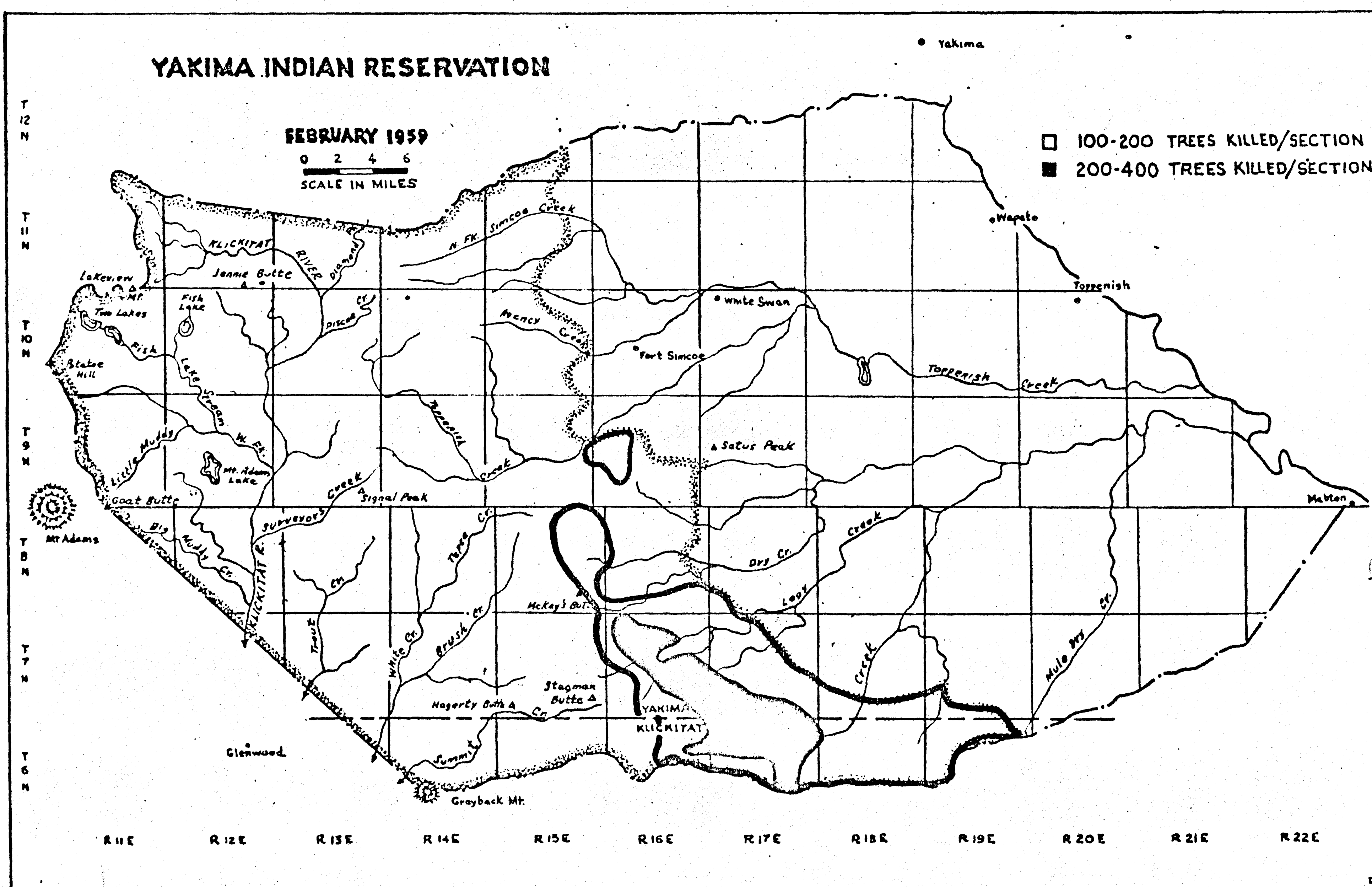
FIG.5 PINE BEETLE FESTATION TRENDS ON FIVE VIRG CHECK PLOTS



The most important natural element controlling beetle populations seems to be the weather. Extremely low winter temperatures, of long duration, have been known to cause drastic reductions in overwintering beetle broods. Mild winters, on the other hand, usually intensify beetle populations. Another important controlling factor may be precipitation. Trees are thought to be better able to "pitch-out" invading beetles if their root systems have been receiving an ample supply of moisture. It is significant that the greatest beetle losses on the Reservation occurred in 1933, following four consecutive years of sub-normal precipitation. (Based on Goldendale, Wn., weather records). The absence of weather stations on the forest itself, prevents meaningful correlation studies between beetle populations and certain weather factors.

B. An outbreak of beetles in 1941 (Fig. 6), led to a comprehensive study of the beetle problem on the Yakima Reservation, by Mr. H. Weaver in the early part of 1942. (16) His report included detailed loss figures for the various regions of the forest, and indicated that the beetle losses on the forest's pine stands averaged 69 bd. ft. per acre per year from 1931-1941. (Losses on 6 check plots, Table 3, indicate an average of 84 bd. ft./acre/year from 1931-1955) Mr. Weaver recommended a form of silvicultural control be initiated in conjunction with the commercial harvesting of mature timber. It was hoped that the elimination of the slower growing and less vigorous individuals in the stand, would reduce the danger of beetle build-ups. The plan called for two basic types of cutting: 1) A heavy, or utilization, cutting that would remove the majority of mature timber; and 2) A lighter, or sanitation-salvage, cutting that would remove only the most highly susceptible beetle trees from the stand. Utilization cuttings were recommended for those areas considered to be most susceptible to beetle attack. The sanitation-salvage operations, on the other hand, were designed for rapid coverage of those areas which wouldn't normally be harvested for a number of years, but where risk of beetle attack was also high. It was hoped that the sanitation-salvage operations would improve the growth and increase the insect resistance of the stand until heavier utilization cuts could be made.

FIG. 6 MAP OF PINE BEETLE EPIDEMIC OF 1941



Mr. Weaver concluded that the Satus, Dry and Logy Creek drainages included the most beetle susceptible pine stands on the reservation. Accordingly, in the latter part of 1944, the first sanitation cutting was begun in a small area in upper Dry Creek (Fig. 7). Nearly one-half of the total merchantable volume, consisting of the highest beetle risk trees, was removed in the cutting. The sale area, which included less than 3½ square miles, couldn't be expanded due to unfavorable economic conditions.

V. THE PAST DECADE (1949-1959)

A. The first utilization cutting on the forest began in 1949 in the Satus Creek and Summit Creek drainages. The Summit Creek Unit included a portion of the stand decimated by the pine butterflies and subsequent beetle attacks. The stands in the Satus Creek Unit has undergone the most recent beetle epidemic (1941-1942), and a large percentage of the remaining trees were considered high beetle risk. Next in the utilization program, were the Dry-Logy Creek and Brush-Tepee Units where cutting began in 1951. Some years later, the Ahtanum Ridge (1957) and Trout Creek (1958) Units were added to the utilization program. (Fig. 7)

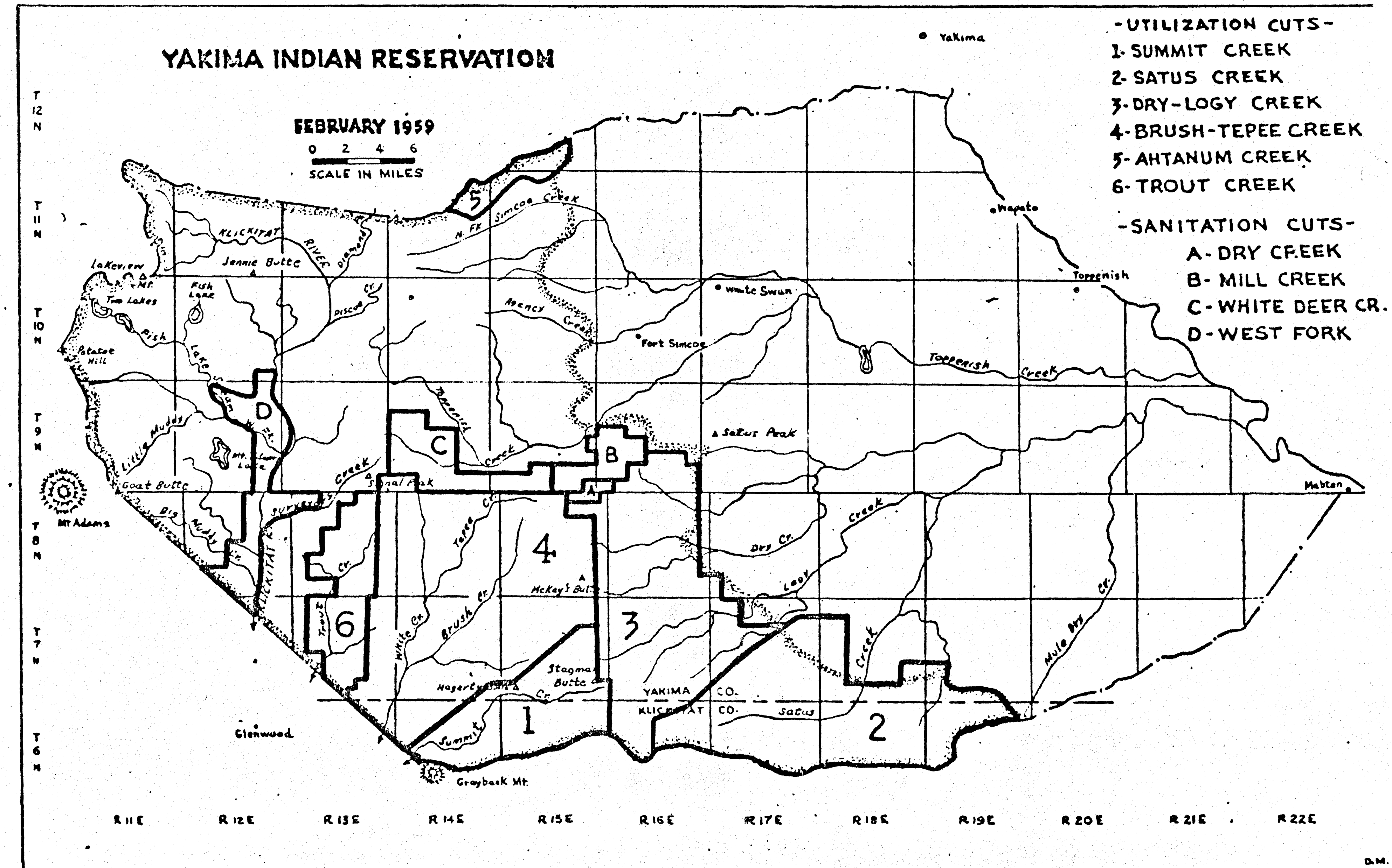
An examination of the Mill Creek area in February 1953 indicated the stands, previously classed as very high beetle risk, had continued to deteriorate, and warranted cutting. (21) Accordingly, the Mill Creek Unit was initially logged on a sanitation-salvage basis in 1953. Eventually, the White-Deer Creek (1955), and West Fork-Big Muddy (1956) Units were included in the sanitation-salvage operations.

The utilization cuttings have generally removed from 40% to 60% of the total merchantable volumes, whereas the sanitation-salvage operations seldom removed more than 20%.

A recognition of the threat presented by the western pine beetle to the Reservation's forest is reflected in the manner in which the harvest areas, and the trees within them, are chosen.

B. Forest insect surveys are regularly conducted in Oregon and Washington under the direction of the Experiment Station. In more recent years, aerial surveys have

FIG. 7 MAP OF LOGGING UNITS



expedited and improved the mapping of insect infestations. The results of these surveys are presented in annual reports. (17,19,22-24) The reports indicate that the pine beetle epidemics of 1931-1934, 1941-1942 and 1951-1953, were not limited to the Reservation, but were part of generalized outbreaks throughout the pine forests of Eastern Washington.

The location of the Reservation's western pine beetle epidemics is shown in Figure 8. The shaded portions include areas of light epidemic infestation (20-50 trees killed per section), as well as the more intense infestations. All infestations are mapped as to year of kill; those after 1951, are based on aerial surveys and related ground checks.

The 1957 and 1958 reports indicate the beetle infestation on the Yakima forest was at a "light epidemic" level, and was increasing. Epidemic infestations were forecast for 1959.

C. In addition to the widespread, devastating attacks by the pine butterfly and the western pine beetle, several other insects have reached epidemic numbers on the Reservation's forest lands. (17,19,22-24) These infestations are considered minor, however, in that they were limited to relatively small areas, seldom lasted more than one season, and were concentrated in the less valuable timber species.

In 1940, a road crew working on Simcoe Mountain, reported extensive killing of white fir in Sections 13, 14, 15, 16, T8N, R16E.. The insect responsible was later identified as Scolytus ventralis, the fir engraver beetle.

The location of the various, localized epidemics is shown in Figure 9. The illustration indicates that these minor epidemics are increasing both in number and kind. However, it must be remembered that the observation and identification of these outbreaks was made possible through certain technological advances, and it is quite likely that similar outbreaks, due to their ephemeral nature, went unnoticed in the past. It is therefore difficult to fully evaluate the present epidemics. Two facts are worth mention: 1) such insect outbreaks are inevitable in a virgin forest, and 2) thus far, these outbreaks have not reached the point where control measures are economically justified.

FIG. 8 LOCATION OF WESTERN PINE BEETLE EPIDEMICS ON THE YAKIMA FOREST

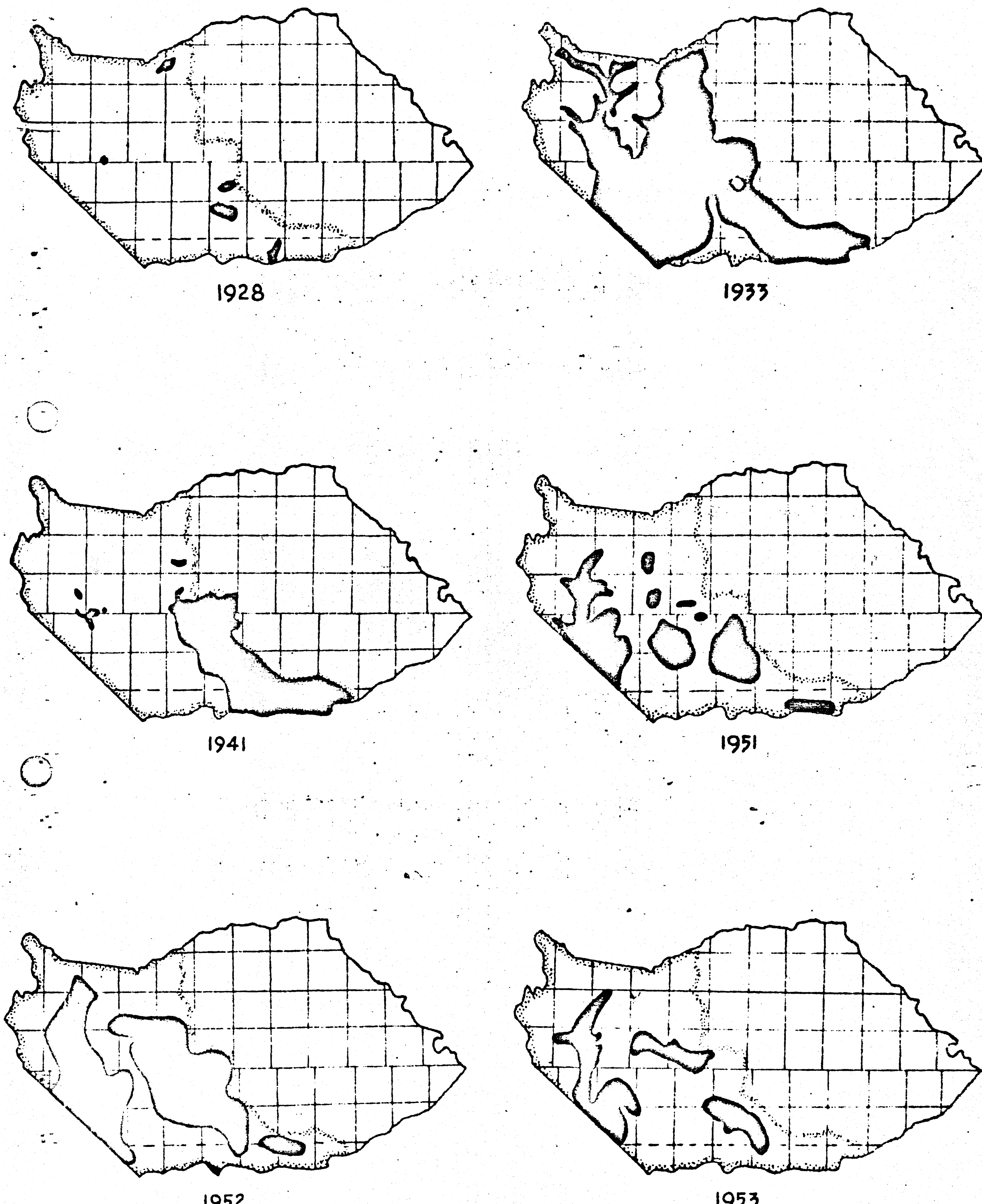


FIG.8 (CON'T.) LOCATION OF WESTERN PINE BEETLE EPIDEMICS ON THE YAKIMA FOREST

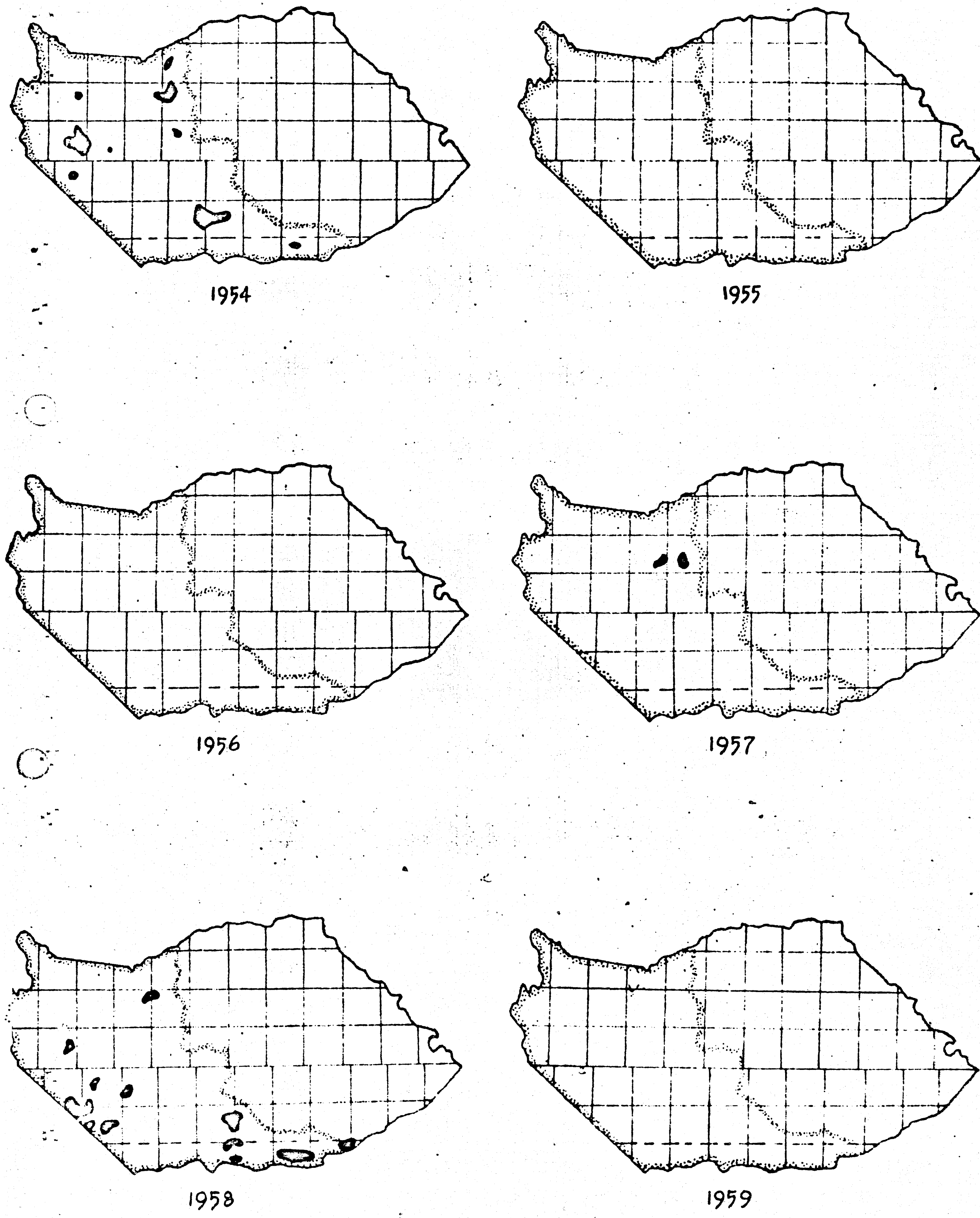
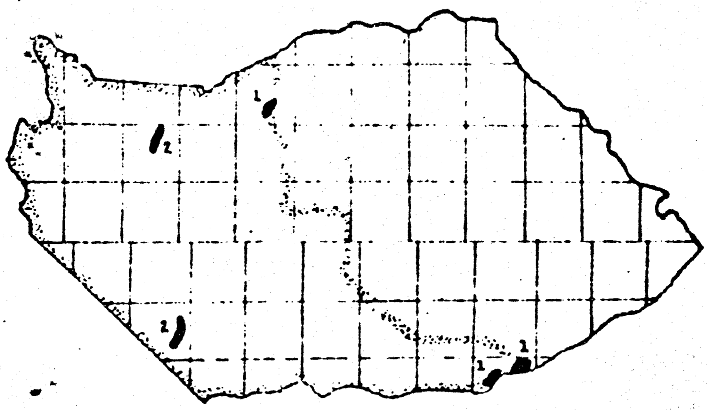
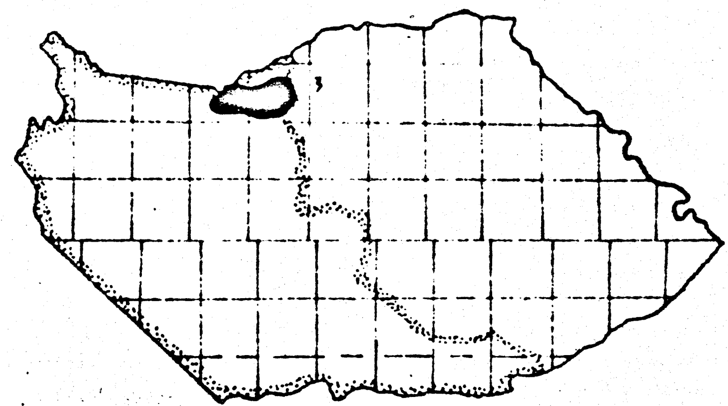


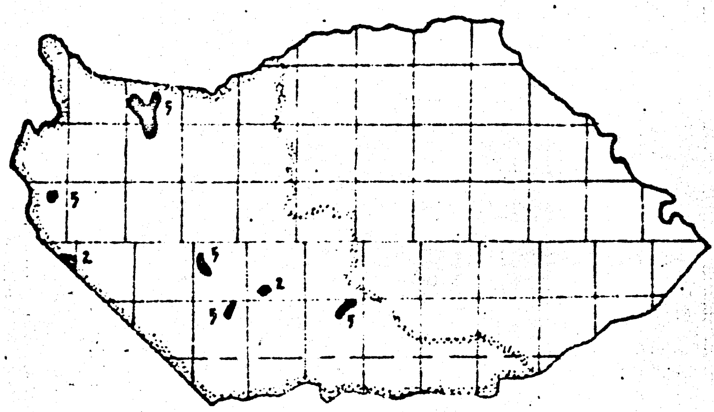
FIG. 9 LOCATION OF O[illegible]R FOREST INSECT EPIDEMICS ON [illegible] RESERVATION



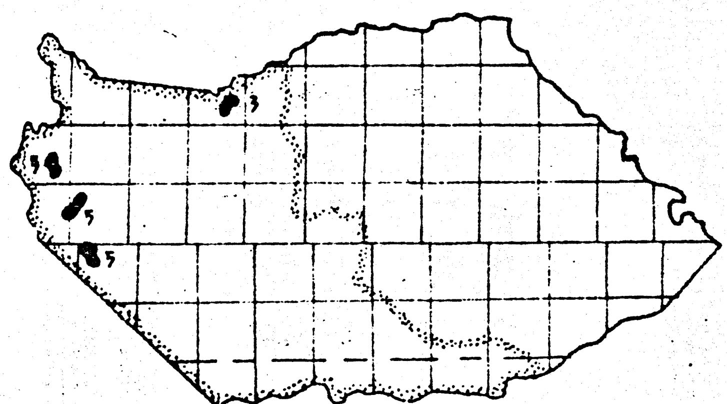
1952
1 - IPS BEETLES
2 - FIR ENGRAVER BEETLE



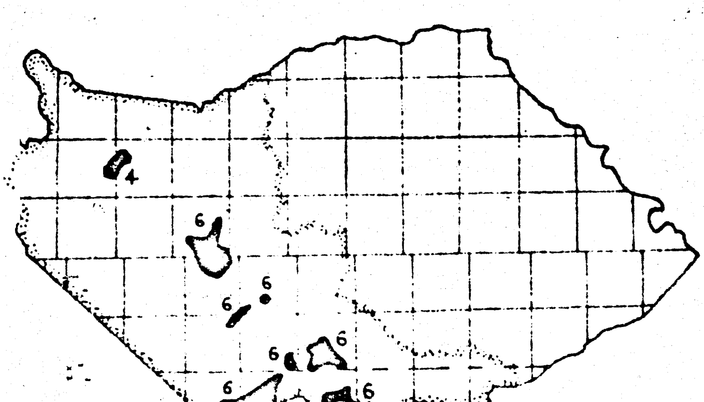
1953
3 - DOUG. FIR BEETLE



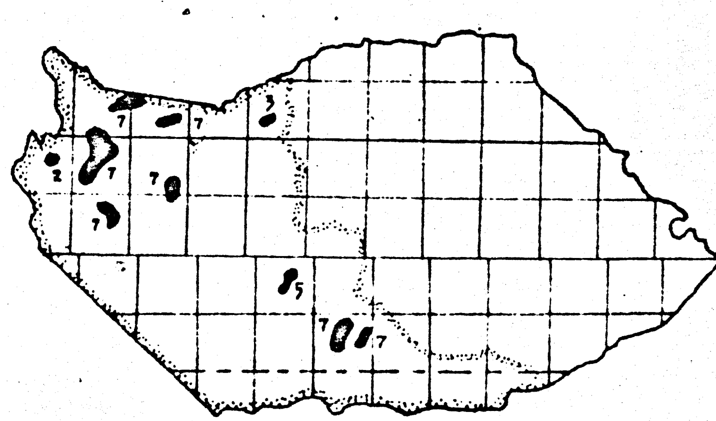
1955
2 - FIR ENGRAVER BEETLE
5 - MOUNT. PINE BEETLE



1956
3 - DOUG. FIR BEETLE
5 - MOUNT. PINE BEETLE



1957
4 - ENGEL. SPRUCE BEETLE
6 - BLK. HEADED BUDWORM



1958
BEETLES: 2 - FIR ENGRAVER 3 - DOUG. FIR 5 - MOUNTAIN PINE; 7 - LARCH BUDWORM

VI. THE EFFECTIVENESS OF BEETLE CONTROL PROGRAMS

A. Studies to determine the effectiveness of control measures are often complicated, and open to serious question because of the numerous variables influencing both beetle populations, and tree mortality. One method of ensuring accurate appraisals of control measures involves the use of sound experimental design and related statistical analyses. When samples must be taken, such procedure is mandatory in order to ensure that: 1) observed differences are real, not due to sampling variations, and 2) differences are due to the control measure, not to other factors. Unfortunately, this type of research is often prohibitively expensive and time consuming, and not in the realm of administrative agencies.

Several earlier studies, though by no means conclusive, do provide interesting and noteworth information. Two analyses of the effectiveness of the "fell-peel-burn" beetle control method, were made by H. Weaver in 1935. The basis of the studies was the 7,840 acres in the Surveyor Creek drainage, which received the first control treatment in the fall of 1933. (11,12)

The first study compared the beetle losses in this area in 1933-1934, with those of 1934-1935. The records showed that the total loss was very much smaller in 1934-1935, and that the large "group killings" which typified the 1933 kill, were virtually non-existant in 1934-1935. The reduction could not be attributed to the control efforts, however, because State-wide losses had also dropped sharply in 1934. (Fig. 3)

In order to demonstrate that control operations effected a reduction of beetle killings, a second study was undertaken. The area previously analysed (Area I), was compared with one which had not received a control treatment prior to 1934. (Area II) Selection of adjacent areas precluded major climatic and biotic differences. The loss data for these two areas is summarized in Table 4 and Figure 10. While both areas showed a marked decrease in beetle killed trees in 1934, Area I showed a greater reduction. The two areas were considered to be sufficiently similar in other respects, to attribute the greater reduction to the "fell-peel-burn" treatment Area I received. (Area I received an additional treatment in the Spring of 1934, and Area II received its first treatment in the fall of 1934.)

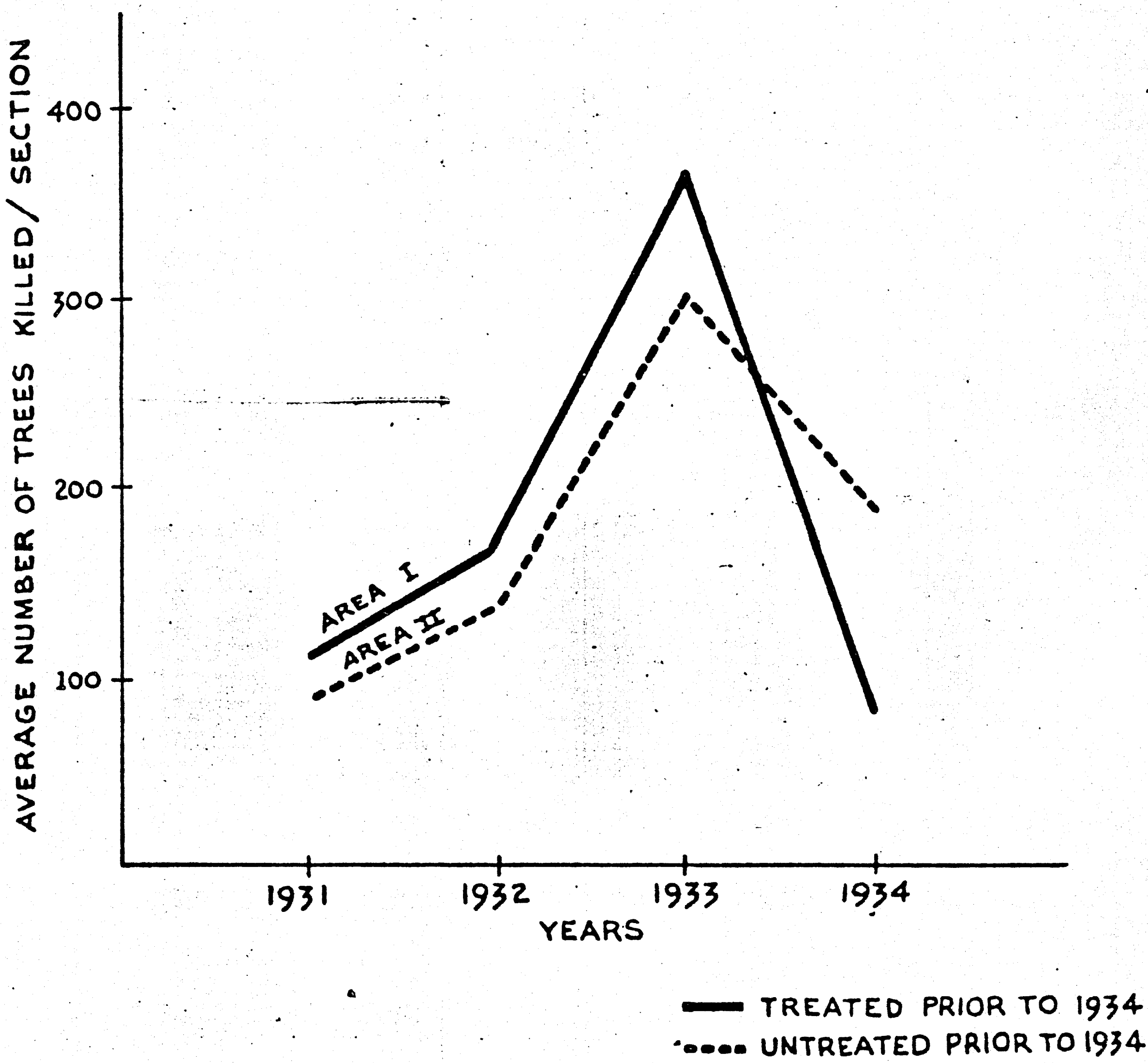


FIG. 10 DIFFERENCE IN BEETLE KILLED TREES IN TREATED AND UNTREATED AREAS

TABLE 4

Number Of Beetle Killed Trees On Areas I and II By Years (Based On 1935 Study)

AREA	NUMBER FORESTED ACRES	YEARS			
		1931	1932	1933	1934
I	7,840	1,305	2,062	4,396	1,064
II	24,240	3,355	5,300	11,292	7,002

B. It is probably still too early to judge the effectiveness of the longer ranged silvicultural control program. However, two study areas which have undergone sanitation cutting bear mentioning.

1. The Smith Spring Check Plot

The Smith Spring plot was cut on a sanitation-salvage basis in late 1944, during the Dry Creek Sale (Fig. 7). Subsequent cruises indicate that beetle losses have remained relatively small since the cutting. This was not the case on the Logy Creek plot, some seven miles southeast of Smith Spring (Table 3 and Fig. 5). Prior to the 1944 cutting, both check plots exhibited similar infestation histories. The light losses on the Smith Spring plot, as opposed to the epidemic losses on Logy Creek, a few miles distant, suggest that the removal of highly susceptible beetle trees was successful in reducing beetle losses. (Fig. 11)

2. The 80 Acre Mortality Plot

An 80 acre mortality plot was established in the Mill Creek Unit (Sec. 25 T9N, R15E) in order to obtain information on cause and extent of tree mortality in a cut-over area. A 100% cruise of green trees, and a tally of snags was made at the time of establishment. The plot was re-cruised in 1956, and each year since. Dead trees are tallied by Keen classes and cause of death, and their volumes computed.

A study of the plot data reveals no significant reduction in beetle killed trees since the cutting. In fact, losses rose sharply in 1958 (Table 5). It is probably still too early to determine the effectiveness

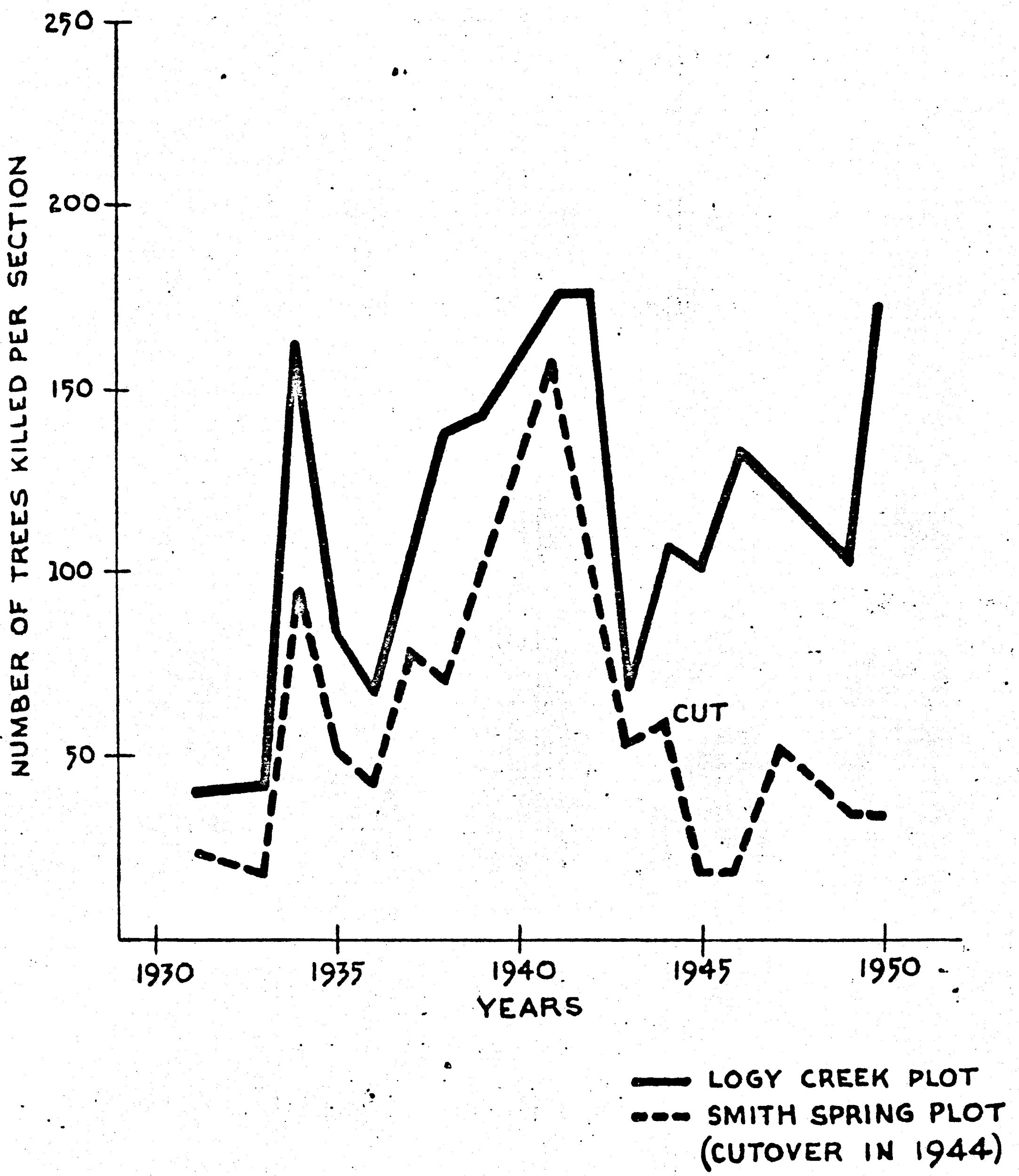


FIG.11 COMPARISON OF NUMBER OF BEETLE KILLED TREES ON A VIRGIN, AND CUTOVER CHECK PLOT

of the sanitation-salvage type cutting in controlling beetle losses in this area.

The distribution of Keen classes among living trees, and among those killed by beetle since 1953, is shown in Table 6 and Figure 12. These data indicate again a surprisingly large percentage of younger trees are represented in the kill, even under endemic and light epidemic attacks. The majority of the trees killed in 1958, and since the cutting have been in the 3-C Keen class. This class was also very hard hit in the 1935 study. (Fig. 4)

The unusual distribution of the 4 age class, is due to the high percentage of these trees which are highly susceptible to beetle attack, and removed in the sanitation-salvage cutting. Not one remaining member of this group has been killed by the beetle.

TABLE 5

Number of Beetle Killed Trees On 80 Acre Mortality Plot (Mill Creek Unit) Since Sanitation Salvage Cutting In 1953.

YEAR	NUMBER OF BEETLE KILLED TREES
Prior to 1953*	20
1953-1956	23
1956-1957	15
1957-1958	29

*Based on Tally of Standing Snags

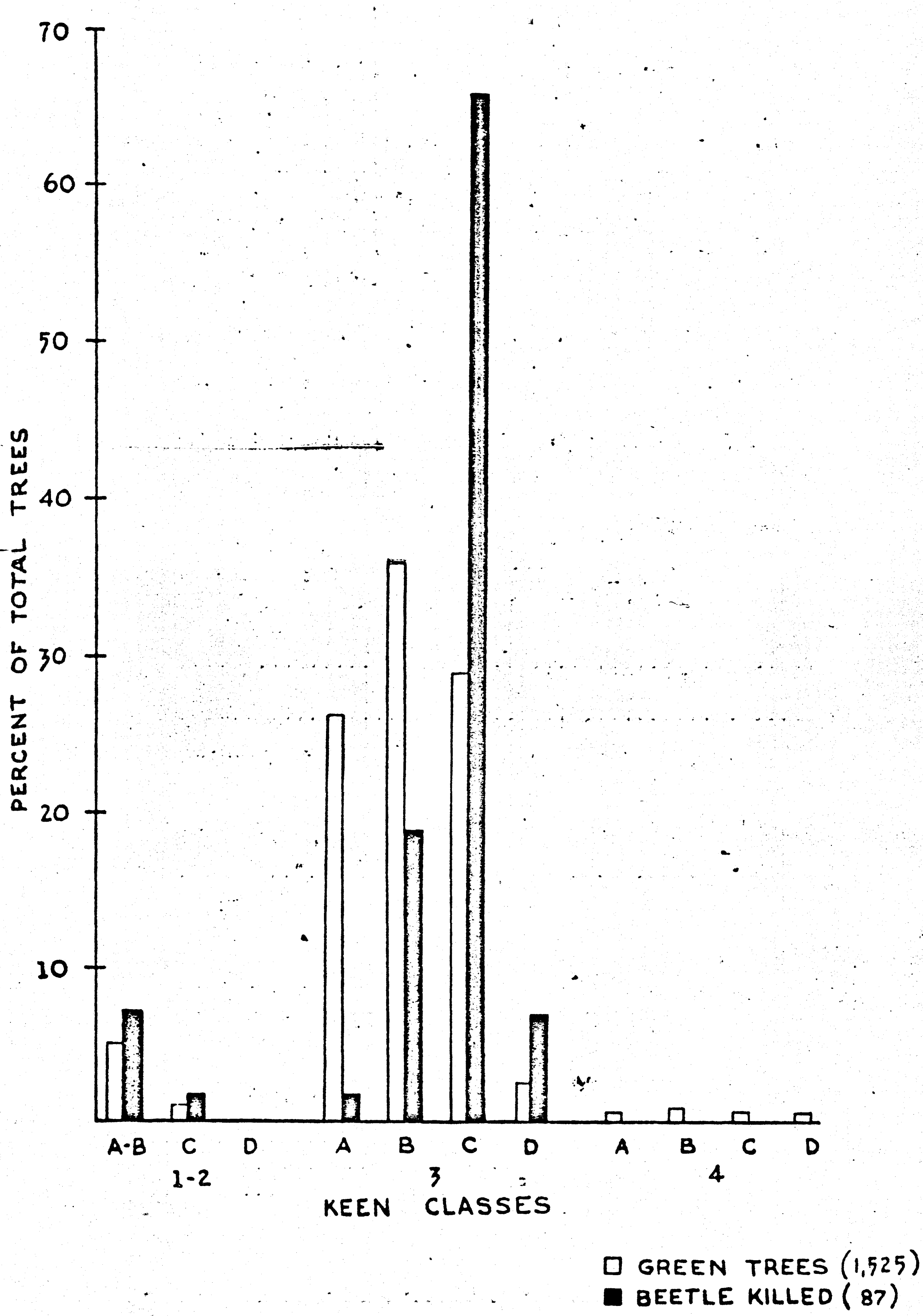
TABLE 6

Distribution Of Keen Classes In Green Trees, And Trees Killed By Beetle In 1953 Through 1958, On 80 Acre Mortality Plot (Mill Creek Unit.)

(Figures Represent Per cent Of Total Trees)

	KEEN CLASSES											
	1 & 2			3				4				Total No.
	A&B	C	D	A	B	C	D	A	B	C	D	Trees
Green Trees	5.0	.9	0	26.0	35.9	29.0	2.6	.1	.3	.1	.1	1,525
Beetle Killed Trees	6.9	1.1	0	1.1	18.5	65.5	6.9	0	0	0	0	87

FIG.12 DISTRIBUTION OF KEEN CLASSES AMONG GREEN TREES, AND TREES KILLED BY BEETLE IN 1953–58, ON MORTALITY PLOT



C. Mr. Weaver, on a visit to the West Fork-Big Muddy salvage unit, noted a considerable group of beetle killed pines just south of the Reservation boundary (J. Neils's lands). The killing occurred in apparently thrifty pines of Keen age class 2, on selectively logged-over land. Similar groups were observed on the West Fork Unit as well. Here again, the attacks were concentrated in groups of younger trees (Keen class 2 and 3), ranging from 20-36 inches in diameter. Mr. Weaver concluded that such attacks are a natural form of thinning which encourages reproduction and regeneration of the forest. (28)

It is Mr. Weaver's opinion that while the lighter cuttings will benefit the stands in the long run, they will not completely solve the beetle problem on the Reservation. Furthermore, he feels silvicultural methods which encourage and protect dense, slow growing understory pine, will also encourage beetle attacks.

D. A mortality study based on the 1957-58 inventory of the Reservation's forest indicates that the annual pine losses averaged 60 bd. ft. per acre during the last 5 years, in the virgin pine type. Mortality in the cutover pine type was significantly lower, averaging only 28 bd. ft. per acre per year. The pine loss in the mixed pine type was found to be 35 bd. ft./acre/year. Although these figures represent total mortality, and include various causal agents, it may be concluded that the majority of these losses is either the direct, or indirect result of beetle attack.

Past studies indicated an average beetle loss of 70 bd. ft./acre/year on the forest. It must be remembered, however, that these earlier studies included years of very severe beetle epidemics which were absent in recent years. The recent mortality figures reflect conditions during relatively light beetle years, and would naturally be lower.

That "over-all" beetle losses averaged 50 bd. ft./acre/year since 1930, would be conservative estimate. Applying this average to the 360,000 acres pine, and mixed pine lands on the reservation, yields a total beetle loss of 540 million feet in the last 30 years. (The total volume of all species removed in the 10 years of commercial logging on the Reservation is approximately 497 million bd. ft.)

CONCLUSION

Insects have depleted the Reservation's forest both in sudden spectacular epidemics, and gradually, during periods of lesser infestations. There is every indication that this pattern will continue in the future, despite our present control efforts. Fortunately, growth has, and probably will continue to offset any serious depletion by insects.

The losses to the western pine beetle have been staggering, making one fact undeniable; the beetle, Dendroctonus (Tree Killer), has been well named.

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